Claims 1-12 were pending in the patent application. By this amendment, Applicants cancel device claims 1-6 without prejudice to the filing of a continuation application to further pursue those claims. Claims 7-11 and newly added dependent Claims 14-16 recite a speech recognition method, while Claim 12 recites a computer readable program stored on a computer readable medium for executing the method.

Claims 1-12 have been rejected under 35 USC § 103 as being unpatentable over Komori in view of Takiguchi. For the reasons set forth below, Applicants respectfully assert that all of the pending claims are patentable over the cited prior art.

The present system and method for speech recognition recognizes original speech input to a single input device even when the speech is superimposed with an echo. The present invention provides a method for performing speech recognition by determining an echo prediction coefficient "showing a rate of an echo to be imposed from a frame in the past to the frame to be evaluated at the current time point (see: page 24, lines 8-11). The present application expressly teaches that "in consideration of the long impulse response, an echo can be sufficiently simulated even if the echo is assumed to be superimposed onto a speech signal 0(w, t) to be determined at the current point in time while being dependent on a speech signal in the immediately

previous frame. That is, but using the formula to determine acoustic model data with the highest likelihood for a speech signal from predetermined acoustic model data and the value of an echo prediction coefficient, it is possible to use corresponding language model data to perform speech recognition using only a speech signal from one channel" (page 25, lines 6-15).

As argued previously, the Komori patent is directed to noise detection wherein noise signals of relatively short duration due to background impulse noise are detected in non-speech intervals and the noise signals are then subtracted from the speech signals received in the speech intervals. Unlike most background noise, as taught by the present Specification and the newly-cited Takiguchi reference, an echo has longer duration than impulse noise and has greater "speech like" characteristics that does background noise. As pointed out by the present Specification, an echo is the result of previous speech, exerting its influence over a longer time period and posing greater challenges to speech recognition because the echo comprises speech signals.

Prior art approaches to noise adaptation, such as the approach taught by Komori, seek to identify the noise in the "non-speech interval" (see: Komori, Col. 2, lines 3-5) and effectively subtract the noise from the speech signal to improve speech recognition. However, a speech signal with a superimposed echo is not going to have any non-speech intervals during which the echo can be isolated, since the echo is a speech signal.

Applicants have previously argued that the Komori patent does not teach the invention as claimed. With specific reference to the claim language, Komori does not teach storing a speech feature quantity acquired from a speech signal (Claim 7) or transforming a received current speech signal into a digital signal and storing the transformed signal with amplitude associated with at time frame (new Claim 15). The Examiner concludes that Komori's sound analysis section "inherently includes a buffer memory for temporarily storing the received speech signal for processing". Applicants respectfully assert that storing a speech signal is not the same as storing a feature quantity acquired from the speech signal. Moreover, a standard FIFO buffer memory would not store a transformed signal along with amplitude and a time frame. The Examiner has erred in concluding that Komori teaches the claim feature.

With respect to the claim feature of reading from said storing portion a speech signal acquired immediately prior to a current speech signal to be processed at the current time point to generate echo speech model data, Komori does not teach or suggest the use of prior speech signals for analysis and echo prediction.

Komori does not teach processing a speech model stored in a storing portion using an echo adaptation model generation portion for generating echo speech model data from a speech signal acquired immediately prior to the current speech signal to be

processed at the current time point. Komori does not teach generating echo speech model data from a speech signal acquired earlier in time. Komori may look to non-speech intervals to detect noise, but does not teach or suggest the use of prior speech signals to extract long interval noise such as an echo (a speech signal in itself). The Examiner has stated at the top of page 3 of the Office Action that "echo can be environmental echo, which is noise". Nonetheless, the Komori patent does not teach the steps for handling a long interval environmental noise.

Since Komori does not teach any steps for detecting or determining echo influence, it cannot be concluded that Komori teaches generating a speech model affected by intra-frame echo influence using acoustic model data and an intra-frame characteristic. Further, Komori does not teach adding the echo speech model data to the speech model affected by intra-frame echo influence to generate an adapted acoustic speech model data and store it in a storage area. Finally, Komori does not teach processing said feature quantity, said adapted acoustic model data, and language model data stored in a storing portion to generate a speech recognition result of the current speech signal.

The Examiner has newly cited the Takiguchi publication for teaching "reverberant speech". The Takiguchi article has common authors as the present application. The Takiguchi article

identifies some of the challenges that echo influence has on speech recognition and seeks to address those challenges. The work described in the Takiguchi article provides some background to the present invention, in identifying the challenges and proposing HMM separation for speech recognition. However, the article does not provide the teachings which are missing from the Komori patent. Takiguchi uses states of the acoustic transfer function HMM to correspond to different speaker locations. Takeguchi does not teach steps of storing a feature quantity acquired from received speech signal, reading and processing a prior speech signal, processing a speech model stored in a storing portion using an echo adaptation model generation portion for generating echo speech model data from a speech signal acquired immediately prior to the current speech signal to be processed at the current time point, generating a speech model affected by intra-frame echo influence using acoustic model data and an intra-frame characteristic; adding the echo speech model data to the speech model affected by intra-frame echo influence to generate an adapted acoustic speech model data and store it in a storage area; and processing said feature quantity, said adapted acoustic model data, and language model data stored in a storing portion to generate a speech recognition result of the current speech signal. (Claims 7 and 12 and the claims which depend therefrom and add limitations thereto). Applicants note

that the Takiguchi article expressly states that "the performance of the proposed method is lower than that of the matched condition...[and that] furtehr improvement of the HMM adaptation method is necessary" (see: page 139, Col. 2).

Applicants respectfully assert that, for a determination of obviousness, the prior art must teach or suggest all of the claim limitations. "All words in a claim must be considered in judging the patentability of that claim against the prior art" (*In re Wilson*, 424 F. 2d 1382, 1385, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). If the cited references fail to teach each and every one of the claim limitations, a *prima facie* case of obviousness has not been established by the Examiner. Since the combination of Komori and Takiguchi does not teach all of the limitations of the claims, a rejection under 35 USC 103 cannot be maintained.

Based on the foregoing amendments and remarks, Applicants request entry of the amendments, reconsideration of the teachings of the references, withdrawal of the rejections, and issuance of the claims.

Respectfully submitted,
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